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(54) PURE TITANIUM AND PURE TITANIUM SHEET FOR BUILDING MATERIAL AND THEIR PRODUCTION

(57)Abstract:

PURPOSE: To produce inexpensive pure titanium with superior formability for building material and al to produce a pure titanium sheet for building material, having surface characteristics with suppressed luster and light-degree reflection of light.

CONSTITUTION: The pure titanium for building material has a composition containing, by weight, Fe, Ni, and Cr by the amounts satisfying inequalities $100 \leq \text{Fe} \leq 600$, $100 \leq \text{Ni} + \text{Cr} \leq 700$, and $\text{Fe} + \text{Ni} + \text{Cr} \leq 1000$ (unit: ppm), also containing ≤ 900 ppm oxygen (O), and having the balance Ti with inevitable impurities. Further, the pure titanium sheet for bulding material, which has the above chemical composition and in which the average crystalline grain size after cold rolling and annealing is regulated to $\leq 70\mu\text{m}$, is obtained.

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CLAIMS

[Claim(s)]

[Claim 1] Pure titanium for building materials with which the content of Fe, nickel, and Cr is satisfied with a weight rate of the following type (1), (2) and (3), and (unit: ppm) with titanium, and oxygen (O) is characterized by the remainder consisting of Ti and an unescapable impurity by 900 ppm or less.

100 ≤ Fe ≤ 600 Formula (1)

100 ≤ nickel + Cr ≤ 700 Formula (2)

Fe + nickel + Cr ≤ 1000 Formula (3)

[Claim 2] The pure titanium plate for building materials which has the chemical composition of claim 1 and is characterized by the diameter of average crystal grain after cold rolling and annealing being 70 micrometers or less.

[Claim 3] The manufacture approach of the pure titanium for building materials according to claim 1 characterized by dissolving a pure titanium scrap and/or titanium sponge as a main raw material.

[Claim 4] The manufacture approach of the pure titanium plate for building materials characterized by performing acid-washing processing to a pure titanium plate according to claim 2 in the nitric-hydrofluoric acid water solution with which are satisfied of the following type (4), (5) (unit: all weight %), and (6).

2 ≤ HF ≤ 7 Formula (4)

4 ≤ HNO₃ ≤ 20 Formula (5)

1 ≤ HNO₃/HF ≤ 5 Formula (6)

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] About the pure titanium for building materials, such as roofing and outer wall material, a pure titanium plate, and its manufacture approach, especially, use of a cheap titanium raw material is possible for this invention, and it relates to the pure titanium plates for building materials with which slight surface gloss was suppressed and those manufacture approaches of the reflection of the pure titanium for building materials, and a beam of light excellent in workability.

[0002]

[Description of the Prior Art] Titanium is lightweight, and since it excels in corrosion resistance extremely, it is utilized for various applications. Recently, the application as building materials for sheathing, such as roofing besides the building materials for interiors and outer wall material, is also increasing. Especially, since titanium has the corrosion resistance which was excellent to seawater, it is applied to the building of a sea-side district more often with development of waterfront.

[0003] As titanium for building materials, since a moldability and workability are required, elastic commercially pure titanium is mainly used. There are three sorts in commercially pure titanium (it is hereafter described as pure titanium) from one sort specified to JISH4600, and it is classified with the content of Fe and O. As an object for building materials, one sort with little Fe and O is used abundantly also in it, and as chemical composition, it is weight % and is specified as Remainder Ti H \leq 0.013%, O \leq 0.15%, N \leq 0.05%, and Fe \leq 0.20%.

[0004] When pure titanium is used as building materials, in order to employ the beautiful front face efficiently, it is used by no painting in many cases. the front face which settled down as an object for interiors when titanium was used by no painting -- description or a color tone is liked. moreover, the front face where reflection of light was suppressed in consideration of giving the ambient atmosphere which settled in the structure as an object for sheathing, the hindrance of operation of the aircraft not becoming, etc. -- the titanium plate of description is called for.

[0005] Generally the sheet metal of pure titanium is manufactured at the following process. First, press working sheet metal of the titanium metal of the shape of sponge with the high purity which is a raw material is carried out and a cylinder-like electrode is made. The arc dissolution is carried out under a vacuum by using this electrode as formula [exhausting] electrode, and an ingot is produced. Next, slabbing of this ingot is carried out and the slab for hot rolling is manufactured. The titanium slab with which surface care and cleaning of removal of a surface crack etc. was performed was softened by annealing processing after hot rolling and cold rolling, and a moldability and workability are given. As this annealing processing, there are a vacuum-annealing method heated under a vacuum and the continuous-annealing method for heating a titanium plate band-like in the inside of atmospheric with a continuous furnace.

[0006] In the case of a continuous-annealing method, after annealing, in order to remove the scale generated on the titanium plate front face, acids, such as nitric-hydrofluoric acid, are used and acid-washing processing is performed. this acid-washing processing -- a front face -- glossy titanium sheet metal with sufficient description is made.

[0007] When aiming at application expansion of pure titanium as an object for building materials, lowering the price of pure titanium is called for most strongly. Being suitable for building materials, since the price is high, by the time it is utilized widely, the actual condition will not have resulted.

[0008] Therefore, about the pure titanium for building materials, in order to aim at much more application expansion and to use as the following (a), (b), and a sheathing material at least, it is necessary to solve the technical problem of (c) to coincidence further.

[0009] (a) A price (manufacturing cost) is cheap.

[0010] (b) Workability and a moldability are good.

[0011] (c) Surface gloss should be suppressed.

[0012] To the manufacturing cost of titanium, the effect of a titanium raw material is large. Since the titanium sponge of the high grade by which current use is carried out needs a lot of power for the purification, its price is high. Therefore, it is difficult to lower the manufacturing cost of the titanium for building materials by the approach of using the titanium sponge of a high grade. Although it is effective in cost reduction to use cheap titanium sponge with low purity with whenever [purification / low], there is a problem that impurities, such as nickel and Cr, mix. Moreover, although there is also a method of using a cheap titanium scrap instead of the titanium sponge of a high grade, mixing of Fe and O is not avoided. Furthermore, since stainless steel may mix into a scrap, the content of impurities, such as nickel and Cr, may become high. If Fe and O mix, Fe exceeds 600 ppm and O exceeds 900 ppm the degree of hardness of pure titanium will become high, and bending workability will worsen. Moreover, in order that nickel and Cr may also raise the degree of hardness of pure titanium, the moldability and the workability of pure titanium are injured. Thus, since these problems are not solved about use of a cheap raw material, the actual condition is not yet industrialized.

[0013] Usually, if fabrication of the pure titanium sheet metal is carried out, it will be easy to generate the defect the shape of flapping called Peco. Since an appearance will be remarkably spoiled when it is used as roofing and outer wall material if this surface discontinuity arises, the special features, such as beautiful [of a front face peculiar to titanium], are lost. The moldability of a pure titanium plate is raised, as a cure which prevents such a defect, to JP,6-10329,B, the pure titanium sheet metal for fabrication of 5-28 micrometers of diameters of average crystal grain is manufactured, and the pure titanium sheet metal with which fabrication is presented, without giving the deformation which exceeds an elastic limit from after annealing before fabrication is indicated by cold rolling and continuous annealing at it.

[0014] Moreover, while removing the scale of the titanium plate after annealing processing, the following approach is shown in JP,60-25506,B as an acid-washing art for obtaining a titanium plate with a beautiful front face without pit crack. It is the approach of carrying out acid-washing processing by immersing a titanium plate in the fluorine acid water solution containing 2 or more g/l of fluorine acid or the fluorine acid water solution containing 2 or more g/l of fluorine acid, and the mixed water solution of a sulfuric acid by the approach, or carrying out the spray of the water solution. It is supposed compared with the acid-washing processing by usual nitric-hydrofluoric acid that the product of a beautiful front face will be obtained.

[0015]

[Problem(s) to be Solved by the Invention] as mentioned above, in order to use titanium as building materials the property which the present pure titanium has -- in addition, a cheap thing, and (a) (b) moldability and workability order to solve two technical problems good [(to describe it as a moldability hereafter)] to coincidence and to use a sheathing material -- further -- reflection of the (c) beam of light -- prevention ***** -- three technical problems of being description must be solved.

[0016] By the approach of JP,6-10329,B and JP,60-25506,B, (a) and (b) or (a) thru/or (c) are unsolvable to coincidence.

[0017] this invention is made in order to solve such a technical problem -- having -- cheap -- the pure titanium for building materials with a sufficient moldability, and the front face where reflection of the beam of light with which glossiness was stopped is still slighter -- it aims at offering the pure titanium plates for building materials with description, and those manufacture approaches.

[0018]

[Means for Solving the Problem] this invention persons did the knowledge of not spoiling a moldability, when restricting Fe, O, nickel, and the amount of Cr(s) which are contained in pure titanium to the moderate range, as a result of considering the usage of titanium sponge with low titanium scrap and purity as a cheap titanium raw material, in order to solve said technical problem. furthermore, the calm front face where surface gloss was suppressed by performing acid-washing processing managed by predetermined conditions to the pure titanium plate with which Fe, nickel, and Cr of optimum dose are contained -- ** was found out when the pure titanium plate suitable for the building materials of description and a color tone was obtained. This invention is completed based on these results, and makes following ** - ** the summary.

[0019] ** The pure titanium for building materials, $100 \leq \text{Fe} \leq 600$ which the content of Fe, nickel, and Cr is satisfied with a weight rate of the following type (1), (2) and (3), and (unit:ppm), and the remainder becomes [oxygen (O)] from Ti and an unescapable impurity by 900 ppm or less Formula (1)

100 \leq nickel+Cr \leq 700 Formula (2)

Fe+nickel+Cr \leq 1000 Formula (3)

It has the same chemical composition as ** *. The diameter of average crystal grain after cold rolling and annealing The pure titanium plate for building materials 70 micrometers or less, ** As opposed to the manufacture approach of the pure titanium for building materials of the above-mentioned ** which dissolves a pure titanium scrap and/or titanium sponge as a main raw material, and the pure titanium plate for building materials of ** * Manufacture approach 2 \leq HF \leq 7 of the pure titanium plate for building materials which performs acid-washing processing in the nitric-hydrofluoric acid water solution with which are satisfied of the following formula (4), (5) (unit: all weight %), and (6) Formula (4)

4 \leq HNO₃ \leq 20 Formula (5)

1 \leq HNO₃/HF \leq 5 Formula (6)

[0020]

[Function] When using a titanium scrap or titanium sponge with low purity as a raw material for pure titanium manufacture and the content of Fe, nickel, and Cr was a suitable amount, this invention persons did the knowledge of the advantageous thing further to manufacture of the pure titanium for building materials with which surface gloss was suppressed, when suitable amount content of Fe, nickel, and the Cr was carried out, not spoiling the moldability of pure titanium, and. By this, use of titanium sponge with low titanium scrap or purity was enabled a raw material for pure titanium manufacture.

[0021] This invention prescribed the diameter of average crystal grain of the content of O, Fe, nickel, and Cr of pure titanium, and a pure titanium plate, and the acid-washing conditions after annealing as mentioned above. The basis is as follows.

[0022] It is necessary to make content of the four above-mentioned element into the following range from a viewpoint of the moldability of a pure titanium plate. If the content of 600 ppm and O exceeds 900 ppm, since Fe content will become [the degree of hardness of pure titanium] high, as for Fe and O, bending workability (moldability) worsens. Therefore, the upper limit of Fe and O was set to 600 ppm and 900 ppm, respectively.

[0023] Moreover, if nickel and Cr have about 1/2 hardenability of Fe to pure titanium, and the sum (nickel+Cr) o the content of nickel and Cr exceeds 700 ppm and the sum (Fe+nickel+Cr) of the content of Fe, and nickel and C exceeds 1000 ppm, the degree of hardness of pure titanium will become high, and moldabilities, such as bending workability, will worsen. Therefore, nickel+Cr was to 700 ppm or less, and Fe+nickel+Cr could be 1000 ppm or less.

[0024] It is better to carry out suitable amount content of Fe, nickel, and the Cr from a viewpoint of the surface gloss of a pure titanium plate. These elements tend to segregate to the grain boundary of pure titanium. Irregularity is formed in a pure titanium front face in order that this segregation section may receive corrosion preferentially the case of acid washing after cold-rolling and annealing titanium material. Consequently, the front face of pure titanium serves as description by which gloss was suppressed and which cannot reflect a beam of light easily. On the other hand, since the grain boundary is hard to be corroded at the time of acid washing when the content of these elements is too low, irregularity to the extent that gloss can be suppressed is not formed in a front face. Therefore, the front face after acid washing is smooth, and serves as a product with high glossiness which gives t impression carried out glitteringly. Therefore, in order to obtain the product with which it needed to be made to contain to some extent and surface gloss was suppressed by acid washing, more than Fe100ppm and more than nickel+Cr100ppm are required for three elements of Fe, nickel, and Cr. When Fe, nickel, and Cr content are with the limits of the upper limit defined from a viewpoint of this lower limit and the above-mentioned moldability, th pure titanium plate with a sufficient moldability with which the surface gloss made into the purpose of this invention was suppressed can be obtained.

[0025] In addition, since the one where O content in pure titanium is lower is desirable, especially a minimum is not specified, but since mixing from a raw material is not avoided, it is set to about 200 ppm practical.

[0026] To the surface gloss of a pure titanium plate, the diameter of crystal grain of a pure titanium plate other th above Fe, nickel, and Cr content does effect. When the diameter of average crystal grain obtained by JISH0501 quadrature is 70 micrometers or more, the depressor effect of surface gloss is small. When each crystal grain is to large, it is because the irregularity of the grain boundary is hard to be reflected in control of surface gloss. Therefore, as for the diameter of crystal grain of pure titanium, it is desirable to be referred to as 70 micrometers less. In addition, especially the minimum of the diameter of average crystal grain is not specified. A minimum is to about 5 micrometers on real production.

[0027] It is desirable to choose proper acid-washing conditions to the surface gloss of a pure titanium plate in

addition to the content of the three above-mentioned elements and the diameter of average crystal grain. A nitric-hydrofluoric acid water solution is used as acid-washing liquid of the pure titanium plate after annealing. Concentration of fluoric acid (HF) cannot fully remove the scale of the pure titanium front face generated by annealing by weight % to the case of under 2% (the concentration display of following and acid-washing liquid i weight %). On the other hand, if the concentration of HF exceeds 7%, the reaction at the time of acid washing will be intense, and the nonuniformity called acid burning on a pure titanium plate front face will occur. Moreover, when the concentration of an acid (HNO₃) is less than 4%, in order that an acid-washing resultant may adhere and remain in the pure titanium front face after acid washing, a front face becomes dirty and it will be in the condition of having worn the black tint with nonuniformity. HNO₃ If concentration exceeds 20%, since surface glossiness will become high too much, the pure titanium plate which suppressed surface gloss is not obtained. HNO₃ Since the cause by which glossiness becomes high on the conditions which are too high has the work to which a nitric acid suppresses the acid-washing reaction of titanium, it is because preferential corrosion of the grain boundary cannot take place easily and irregularity is hard to be formed in the grain boundary.

[0028] About acid-washing liquid, it is HF and HNO₃. It is desirable to choose the conditions proper about both ratio-of-concentration HNO₃ / HF other than concentration. Less than by one, the pure titanium plate front face after acid washing becomes dirty, and HNO₃ / HF will be in the condition of having worn the black tint with nonuniformity. If HF exceeds HNO₃/5, since the glossiness of a pure titanium plate front face will become high much, the pure titanium plate which suppressed surface gloss is not obtained.

[0029] Therefore, as acid-washing liquid used for this invention, the concentration of HF is 2% or more, 7% or less and HNO₃. 1 or more and 5 or less nitric-hydrofluoric acid water solution is [concentration] suitable for both ratio-of-concentration HNO₃ / HF 4% or more and 20% or less.

[0030] It permits that the pure titanium of this invention contains Fe, nickel, and Cr within the limits of the above. Therefore, cheap raw materials, such as titanium sponge with low titanium scrap or purity, can be used as a titanium raw material for pure titanium manufacture. These raw materials may be used independently and may use both together. Moreover, when content, such as Fe, nickel, and Cr, becomes high too much from these raw materials, is good by blending titanium sponge with high purity to carry out a quality governing. Content as an impurity contained in titanium raw materials, such as titanium sponge with low titanium scrap or purity, such as Fe, nickel and Cr, has the quite large range of fluctuation. Therefore, to use these raw materials, to opt for raw material combination is required so that the content of an impurity element may be investigated and it may go into the chemical composition range of the pure titanium of this invention beforehand.

[0031]

[Example]

(Example 1) In the example 1, the effect of O, Fe, nickel, and Cr content which are exerted on the moldability of pure titanium plate and surface gloss was investigated.

[0032] The chemical composition of 20 pure titanium ingots used for test specimen production was shown in Table 1. Test specimen No.1-13 are pure titanium of this invention, and test specimen No.14-20 are pure titanium as comparison material.

[0033]

[Table 1]

表 1

区 分	供 試 材 No	化学組成(ppm)						成形性		表面光沢		総 合 評 価
		O	Fe	Ni	Cr	Ni+ Cr	Fe+Ni +Cr	硬度	評 価	光沢 度	評 価	
本 発 明 例	1	255	232	85	75	160	392	134	○	15	○	○
	2	353	224	96	88	184	408	147	○	20	○	○
	3	552	222	80	75	155	377	163	○	18	○	○
	4	339	105	98	90	188	293	135	○	28	○	○
	5	312	206	92	79	171	377	146	○	22	○	○
	6	333	381	99	81	180	561	152	○	20	○	○
	7	343	571	88	70	158	729	168	○	16	○	○
	8	323	251	125	58	183	434	157	○	28	○	○
	9	344	242	201	81	282	524	161	○	22	○	○
	10	328	255	352	85	437	692	160	○	21	○	○
	11	456	243	125	210	335	578	163	○	19	○	○
	12	461	240	133	362	495	735	159	○	16	○	○
	13	422	255	335	361	696	951	168	○	13	○	○
比 較 例	14	959*	251	75	98	173	424	190	×	17	○	×
	15	351	85*	81	76	157	242	124	○	38	×	×
	16	352	611*	101	92	193	804	185	×	15	○	×
	17	355	233	45	40	85*	318	136	○	38	×	×
	18	343	241	372	369	741*	982	181	×	11	○	×
	19	313	351	344	362	706*	1,047*	191	×	10	○	×
	20	301	520	335	325	660	1,180*	186	×	11	○	×

*：本発明の範囲外

[0034] As a titanium raw material for a titanium ingot ingot, titanium sponge with high purity (2151 to one sort o JISH(s)) was used to test specimen No.1-10 and No.14-20. To test specimen No.11-13, the titanium scrap (O:0.045%, Fe:0.025%, nickel:0.007%, Cr:0.0067%, and all are weight %) of the shape of fine swarf was used. I addition, pure Fe, pure nickel, and pure Cr were used as Fe, nickel, and a raw material for Cr content adjustment. The ingot of an ingot used the plasma arc furnace and twisted it to the approach of dissolving the raw material of the predetermined blending ratio of coal under an argon ambient atmosphere. Magnitude is 150mm in the thickne of 20mm, width of face of 60mm, and die length, and weight of an ingot is 800g.

[0035] After heating at 950 degrees C and forging to 10mm in thickness, further, the obtained ingot was heated a 850 degrees C, and was hot-rolled to 5mm in thickness. The material after rolling machined the front face to 4mm in thickness, in order to remove a surface scale. Then, it rolled out between the colds from 4mm in thickness to 0.8mm.

[0036] From the material after rolling, the test piece with a width of face [of 20mm] and a die length of 150mm was cut down. The test piece was annealed in atmospheric air by holding for 5 minutes in temperature of 700 degrees C. Acid-washing processing was performed to the test piece after annealing on the conditions immersed a 30-degree C nitric-hydrofluoric acid water solution (HF:3%, HNO3:10%, HNO3/HF:3.3) for 2 minutes, and th scale on the front face of a test piece generated on the occasion of annealing was removed. The diameter of avera crystal grain of each test piece was about 10-80 micrometers.

[0037] Evaluation of a test piece was based on the glossiness by the 60-degree specular-gloss method a moldabil is specified by Vickers hardness and surface gloss is specified to it JISZ8741. In addition, measurement of a degr of hardness performed the longitudinal section of a test piece, and measurement of glossiness in respect of rolling [0038] These results of an investigation were collectively shown in Table 1. Since the degree of hardness was too high and the moldability worsened when Vickers hardness exceeded 170, it carried out to the poor moldability (x

moreover, the front face where gloss was suppressed when glossiness exceeded 30 -- since it did not become description, it carried out to poor surface gloss (x) in that case. The reason for having made 30 or less glossiness into good (O) is in agreement also with this range being the specular gloss from which the feeling gloss of a cent vision of inside gloss is acquired under the Measuring condition of the 60-degree specular gloss based on JISZ8741.

[0039] Like [it is ***** from Table 1 and], the pure titanium plate of this invention of test specimen No.1-13 h a good moldability, surface gloss is also suppressed, and it has the property suitable for the building materials ma into the purpose of this invention. It was checked to it that the pure titanium plate for the comparison of test specimen No.14-20 becomes poor [a moldability or surface gloss] since the range of this invention of chemical composition is out of range. Moreover, about test specimen No.11-13 using the titanium scrap as a titanium raw material, since chemical composition is within the limits of this invention, a moldability and surface gloss are go From this result, even if it used raw materials other than the titanium sponge of a high grade, when chemical composition was within the limits of this invention as a titanium raw material, it was proved that there was no eff in the property of a pure titanium plate.

[0040] (Example 2) The effect of the diameter of crystal grain exerted on the surface gloss of a pure titanium pla was investigated. The cold rolling material of the chemical composition same as a test specimen as test specimen No.6 used in the example 1 was used. From cold rolling material, 20mm long and a 20mm wide test piece were c down, this test piece was annealed on the conditions held for 5 minutes to each temperature from 550 degrees C every 50-degree-C850 degrees C, and the test piece with which the diameters of average crystal grain differ was prepared. Furthermore, acid-washing processing was performed on the same conditions as an example 1 to the te piece after annealing. About the obtained test piece, according to the quadrature of JISH0501, the diameter of average crystal grain was measured in the longitudinal section parallel to a rolling direction, and surface specular gloss was measured by the same approach as an example 1. The results of an investigation were shown in Table [0041]

[Table 2]

表 2

区 分	試験 No	焼鈍条件	平均結晶 粒径 (μ m)	表面光沢 度	総合評価
本発明 例	1	550℃×5min	3	15	○
	2	600℃×5min	5	17	○
	3	650℃×5min	13	18	○
	4	700℃×5min	31	20	○
	5	750℃×5min	52	22	○
	6	800℃×5min	68	27	○
比較例	7	850℃×5min	88	32	×

[0042] the front face where the surface glossiness of the pure titanium plate (trial No.1-6) of this invention 70 micrometers or less is [the diameter of average crystal grain] 30 or less, and gloss was suppressed -- it turns out that it is description. If the diameter of average crystal grain exceeds 70 micrometers to it (trial No.7), surface glossiness is over 30 and it can be said that glossiness is too high. From this result, as for the diameter of average crystal grain of a pure titanium plate, it was checked that 70 micrometers or less are suitable.

[0043] (Example 3) The effect of the acid-washing conditions exerted on glossiness was investigated. The cold rolling material of the chemical composition same as a test specimen as test specimen No.6 used in the example 1 was used. Cold rolling material was annealed on condition that 700 degrees C and the maintenance during 5 minutes, and 50mm long and a 50mm wide test piece were cut down. Acid washing was carried out with the nitr hydrofluoric acid water solution of the monograph affair which shows this test piece in Table 3. Temperature of acid-washing liquid was made into 30 degrees C, and the holding time was made into 2 minutes. About the test piece after acid washing, the effectiveness of acid washing which contains descaling nature by surface observatio was investigated, and surface glossiness was measured by the same approach as an example 1. These results of a investigation were shown in Table 3.

[0044]

[Table 3]

表3

区分	試験 No	酸洗液組成 (重量%)			外観観察結果		表面光沢		総合 評価
		HF	HNO ₃	HNO ₃ /HF	評価	備考	光沢 度	評価	
本 発 明 例	1	2	4	2.0	○		13	○	○
	2	2	7	3.5	○		22	○	○
	3	3	4	1.3	○		15	○	○
	4	3	10	3.3	○		20	○	○
	5	3	16	5.3	○		25	○	○
	6	5	5	1.0	○		14	○	○
	7	5	10	2.0	○		21	○	○
	8	5	20	4.0	○		26	○	○
	9	7	7	1.0	○		16	○	○
	10	7	10	1.4	○		22	○	○
	11	7	20	2.9	○		28	○	○
比 較 例	12	1.5*	3*	2.0	×	スケール残り	—	—	×
	13	1.5*	6	4.0	×	スケール残り	—	—	×
	14	1.5*	10	6.7	×	スケール残り	—	—	×
	15	2	3*	1.5	×	表面汚れ	—	—	×
	16	2	11	5.5*	○		40	×	×
	17	3	3*	1.0	×	表面汚れ	—	—	×
	18	3	20	6.7*	○		43	×	×
	19	5	3*	0.6*	×	表面汚れ	—	—	×
	20	5	4	0.8*	×	表面汚れ	—	—	×
	21	5	22*	4.4	○		33	×	×
	22	7	6	0.9*	×	表面汚れ	—	—	×
	23	7	22*	3.1	○		38	×	×
	24	8*	8	1.0	×	酸焼け	—	—	×
	25	8*	20	2.5	×	酸焼け	—	—	×

*：本発明の範囲外

[0045] About trial No.1-11 of the example of this invention, since acid-washing conditions are within the limits of this invention, survival of a scale, dirt, etc. are not in a test piece front face, and a front face is pure. moreover, the front face on which glossiness was also suitable for the building materials by which gloss was suppressed by 30 or less -- it is description. There are many survival of a scale and dirt are accepted to be to a test piece front face about trial No.12-25 of the example of a comparison to it since the acid-washing conditions of this invention are out of range. Furthermore, there are many to which glossiness exceeds 30. Thus, in the case of the example of a comparison, there was nothing that fulfills all the conditions of that there are not survival of a scale and dirt and being 30 or less glossiness.

[0046] From this result, it was checked as acid-washing conditions that the conditions of this invention are suitable

[0047]

[Effect of the Invention] the pure titanium for building materials of this invention -- O, Fe, nickel, and Cr -- specified quantity **** -- since things are permitted, a cheap titanium scrap or titanium sponge with low purity can be used as a raw material for pure titanium manufacture. Therefore, pure titanium equipped with the moldability as an object for building materials with a cheap price is obtained. moreover, the thing which Fe, nickel, and Cr of a suitable amount are contained in pure titanium, and the diameter of average crystal grain of a pure titanium plate within the limits of predetermined -- in addition, the slight front face of reflection of the beam of light with which

surface gloss was suppressed since conditions suitable as acid-washing conditions after annealing were defined - the pure titanium plate for building materials equipped with description suitable for sheathing is obtained. Thus, according to the pure titanium for building materials, the pure titanium plate, and its manufacture approach of this invention, since pure titanium suitable as a cheap object for building materials and a pure titanium plate are obtained, the application expansion to the building materials of pure titanium etc. does so the effectiveness which was excellent on industry.

[Translation done.]